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Network Working Group
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GADS

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Toward an Internet Standard Scheme for Subnetting

STATUS OF THIS MEMO

This RFC discusses standardizing the protocol used in subnetted environments in the ARPA-Internet. Distribution of this memo is unlimited.

The author of this RFC is the Gateway Algorithms and Data Structures (GADS) Task Force, chaired by David L. Mills.

INTRODUCTION

Several sites now contain a complex of local links connected to the Internet via a gateway. The details of the internal connectivity are of little interest to the rest of the Internet.

One way of organizing these local complexes of links is to use the same strategy as the Internet uses to organize networks, that is, to declare each link to be an entity (like a network) and to interconnect the links with devices that perform routing functions (like gateways). This general scheme is called subnetting, the individual links are called subnets, and the connecting devices are called subgateways (or bridges, or gateways).

All hosts in the Internet must make a decision when sending a datagram, that is, they must answer the question "Is this datagram addressed to a host on a directly connected network, or must it be sent to a gateway?". In a subnetted environment, this question is extended to "Is this datagram addressed to a host on a directly connected subnet, or must it be sent to a (sub)gateway?". Let us call answering this question "making the routing decision".

Because the hosts used in a subnetted environment must implement in their IP or network interface software procedures for making the routing decision, and because such hosts may be acquired from various sources, it is important that a standard subnetting scheme be identified so that different suppliers can provide compatible hosts (that is, hosts compatible with the complexes at different sites and each other). Without a designated standard for a subnetting scheme suppliers can not create compatible hosts.

The potential problem is that if different subnetting schemes are developed by different suppliers a customer that installs hosts from two or more suppliers may find that they do not work together.

This topic has been discussed in a set of RFCs [1,2,3,4] and in a flurry of messages in the Gateway Algorithms and Data Structures Task Force. It is strongly suggested that if subnetting is used at all, it be according this new standard scheme.

APPROACH

An Internet address currently consists of a two-layer hierarchy, a 'network' and a per-network 'rest' field. This subnet scheme adds an optional 'subnet' layer and field.

The subnet field is created by stealing some bits from the rest (or host) field of the address. The details of the subnet field are site specific. All three classes (A, B, and C) of networks may be subnetted.

The use of subnets is an optional local decision. The fact that a network has subnets is invisible outside that network, and the change is local and can be instituted at a site without any global Internet perturbations. A complex of links is assigned a single IP network number, and outside that complex it appears as a single network with that number. Only inside does local structure appear.

However, while the decision to use subnets at a site is optional, any IP implementation which may possibly be used in a potentially subnetted environment, should provide for subnet field configuration as described above. Such an implementation will function properly in environments with or without subnetting. On the other hand, implementations lacking this provision will not function in a subnetted environment, and are thus potentially less useful.

This specifications is not intended to require a particular implementation technique inside the host, but rather to define the external behavior of the host in a subnetted environment. It does not specify how routing is done or the details of host construction. Note that gateways are hosts, too.

However, it seems easiest to explain the approach by describing one possible host implementation.

Example Implementation:

Let us use "subnet" to mean the locally attached transmission medium.

The key decision to be made is "Is the destination IP address

on my subnet or not?". Once this decision is made the host knows to whether to send the datagram directly to the destination on the subnet or to send the datagram to a gateway.

The host uses a 32-bit mask, along with the host's own IP address, to determine whether or not destination IP addresses are on its subnet.

The mask can be configured at boot time as a static quantity or distributed by a protocol that is beyond the scope of this memo.

If the bitwise AND of the mask with the destination IP address matches the bitwise AND of the mask with the host's own IP address, the destination is assumed on its subnet; if not, the destination is assumed on a subnet or network reachable only via a gateway.

> Note: if the mask is all zeros, all destinations will appear to be on this subnet; while, if the mask is all ones, only the sending host itself will appear to be on this subnet. If the mask contains ones in the network field and zeros in the rest field, subnets are not in use.
>
> The above procedure must be treated as a per interface procedure for multihomed hosts.

For further information on background and rationale, see RFC-917, "Internet Subnets" [1].

REFERENCES

[1] Mogul, J., "Internet Subnets", RFC-917, Stanford University, October 1984.

[2] Postel, J., "Multi-LAN Address Resolution", RFC-925, USC/Information Sciences Institute, October 1984.

[3] Clark, D., "A Subnetwork Addressing Scheme", RFC-932, MIT LCS, January 1985.

[4] Karels, M., "Another Internet Subnet Addressing Scheme", RFC-936, UC Berkeley, February 1985.